

Fisher® Large ET and ED Valves NPS 12 through 16 and NPS 30

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Figure 1. Fisher NPS 12 Valve with Piston Actuator and FIELDVUE™ DVC6200 Digital Valve Controller



X0237-1

Introduction

Scope of Manual

This instruction manual includes installation and maintenance information for NPS 12 through 16 and NPS 30 CL150 through 600 Fisher ET and ED valves.

Refer to separate manuals for instructions covering the actuator and accessories.

Do not install, operate, or maintain an ET or ED valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. **To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings.** If you have any questions about these instructions, contact your Emerson Process Management sales office before proceeding.



Table 1. Specifications

<p>Valve Sizes</p> <p>ET and ED: NPS ■ 12, ■ 14, ■ 16 and ■ 30</p> <p>End Connection Styles</p> <p><i>Flanged:</i> CL150, 300, and 600 raised-face or ring-type joint flanges per ASME B16.5 <i>Buttwelding:</i> All ASME B16.25 schedules through schedule 120 that are compatible with the ASME B16.34 valve body rating For other end connections, contact your Emerson Process Management sales office for details</p> <p>Maximum Inlet Pressure and Temperature⁽¹⁾</p> <p><i>Flanged:</i> Consistent with CL150, 300, and 600 pressure/temperature ratings per ASME B16.34 <i>Buttwelding:</i> Consistent with CL600 per ASME B16.34 Also see the Installation section</p> <p>Shutoff Classifications per ANSI/FCI 70-2 and IEC 60534-4</p> <p>ET and ET-C with Metal Seats <i>Standard:</i> Class V <i>Optional (for all trims except 2-Stage Cavitrol™ Trim):</i> Class IV</p> <p>ED with Metal Seats <i>Standard:</i> Class IV <i>Optional:</i> Class V</p>	<p>Flow Characteristics</p> <p>Standard Cages: ■ Linear or ■ equal percentage WhisperFlo™, Whisper Trim™ III, and Cavitrol III Cages: Linear</p> <p>Flow Direction</p> <p>Standard and Cavitrol III Cages: Down WhisperFlo and Whisper Trim III Cages: Up</p> <p>Port Diameters</p> <p>NPS 12, 14, and 16 Trim: 279.4 mm (11.00 inches) and 254 mm (10.00 inches) NPS 30 Trim: 609.6 mm (24.00 inches)</p> <p>Valve Plug Travel</p> <p>102 through 432 mm (4 to 19-7/8 inches). Contact your Emerson Process Management sales office for further details if needed</p> <p>Yoke Boss and Stem Diameters</p> <p>■ 127 mm (5H-inch) diameter yoke boss, with 31.8 mm (1-1/4 inch) diameter valve stem for all valves except NPS 30 ■ 179 mm (7-inch) diameter yoke boss, with 50.8 mm (2 inch) diameter valve stem for NPS 30 valve</p> <p>Approximate Weights</p> <p>See table 6</p>
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1. Do not exceed the pressure or temperature limits in this manual, on the equipment nameplate, and any applicable code limitations.

Educational Services

For information on available courses for Fisher Large ET and ED valves, as well as a variety of other products, contact:

Emerson Process Management
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
<http://www.emersonprocess.com/education>

Table 2. WhisperFlo Trim Specifications

<p>Trim Material and Selection</p> <ul style="list-style-type: none"> ■ 316 Stainless Steel w/ hardfacing ■ 410 Stainless Steel, hardened ■ Others per application <p>Temperature Capability</p> <ul style="list-style-type: none"> ■ ET: -73 to 232°C (-100 to 450°F) up to 316°C (600°F) with HTS1 option ■ ED: -29 to 538°C (-20 to 1000°F) ■ Others per application <p>Maximum Pressure Drops</p> <p>As shown in this bulletin. Also see Bulletin 51.1:Large_ET_ED, Fisher Large ET and ED Valves NPS 12 through 16</p> <p>WhisperFlo Aerodynamic Trim Pressure Ratings^(1,2)</p> <p>Up to 1500 psi drop</p> <p>Velocity Limits</p> <p>WhisperFlo trim is designed for 0.3 MACH as an inherent outlet velocity limit. Variations higher and lower may be applied per special applications -</p>	<p>consult your Emerson Process Management sales office</p> <p>Flow Characteristic</p> <p>Linear (restricted linear cages and special, characterized cages are available--consult your Emerson Process Management sales office)</p> <p>Rangeability</p> <p>65:1 High rangeability in excess of 250:1 is available in some constructions. Contact your Emerson Process Management sales office for details</p> <p>Flow Direction</p> <p><i>Standard and Cavitrol III Cages: Down</i> <i>Whisper Trim III Cages: Up</i> <i>WhisperFlo Cages: Up</i></p> <p>Noise Attenuation</p> <p>Approximately -40 dBA maximum depending on the $\Delta P/P_1$ ratio per IEC 60534-8-3 calculation procedure</p>
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1. Other pressures on application.

2. The pressure/temperature limits in this instruction manual and in any applicable standard limitations should not be exceeded.

Description

Fisher NPS 12 through 16 and NPS 30 CL150 through CL600 ET and ED control valves are used for either throttling or on-off control of a wide variety of liquids and gasses.

ET valves with a hanging cage are available for demanding applications in oil and natural gas up to 232°C (450° F). The hanging cage, with the seat ring threaded into the cage, provides the valve with easy-maintenance trim. The seal between the plug and cage and the seal between the seat ring and body are spring-loaded PTFE. The spring-loaded PTFE seal configuration can provide Class V shutoff per ANSI/FCI 70-2 and IEC 60534-4. The temperature range can be extended to 316°C (600°F) for non-oxidizing service and to 260°C (500° F) for oxidizing service by using PEEK (Poly Ether Ether Ketone) anti-extrusion rings in combination with the spring-loaded PTFE seals.

ED valves also utilize a hanging cage and a seat ring that is bolted into the body. These valves have metal-to-metal seating and two graphite piston rings between the cage and plug. They are used for high temperature applications between 316°C (600°F) and 593°C (1100° F) with a Class IV standard shutoff. Shutoff can be increased to Class V by using the Bore seal trim.

To help reduce aerodynamic noise in gas service, Whisper Trim III and WhisperFlo cages are available. Cavitrol III cages are available to eliminate the effects of liquid cavitation damage and DST, Dirty Service Trim, is available for cavitating liquid with particulates.

Fisher WhisperFlo trim represents state of the art solutions for applications that demand ultimate aerodynamic noise attenuation.

Control valves with WhisperFlo cages provide additional aerodynamic noise attenuation in very demanding vapor or gas applications with high-pressure drops. A WhisperFlo cage with an appropriately sized valve body is designed to reduce the noise level up to -40 dBA. For special applications, -50 dBA attenuation can be achieved.

Specifications

Typical specifications for these valves are shown in tables 1 and 2. Some of the specifications for a given valve assembly as it comes from the factory appear on the actuator nameplate if the valve is part of a complete control valve assembly.

Installation

WARNING

To avoid personal injury or property damage resulting from the sudden release of pressure, do not install the valve assembly where service conditions could exceed the limits given in this manual or on the appropriate nameplates. Use pressure-relieving devices as required by government or accepted industry codes and good engineering practices.

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

The valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Because some valve body/trim material combinations are limited in their pressure drop and temperature range capabilities, do not apply any other conditions to the valve without first contacting your Emerson Process Management sales office.

WARNING

If you are hoisting the valve, use nylon slings to protect the surfaces.

Carefully position the slings to prevent damage to the actuator tubing and any accessories. Also, take care to prevent people from being injured in case the hoist or rigging slips unexpectedly. Refer to table 6 for valve assembly weights. It is important to use adequately sized hoists and chains or slings to handle the valve.

1. Before installing the valve, inspect the valve and associated equipment for any damage and any foreign material.
2. Make certain that the valve body interior is clean, that pipelines are free of foreign material, and the valve is oriented so that pipeline flow is in the same direction as the arrow on the side of the valve.

CAUTION

For long service life and more effective operation, the process liquid must be clean. If the valve being installed has a Whisper Trim, WhisperFlo, or Cavitrol Trim cage with small internal flow passages, impurities or entrained solids in the

process liquid may cause irreparable erosion damage to the seating surfaces and may plug cage holes and passages, causing cavitation damage. During valve installation or the plant cleaning cycle, install a strainer upstream from the valve to help free pipelines of foreign material.

3. The control valve assembly may be installed in any orientation unless limited by seismic criteria. However, the normal method is with the actuator vertical above the valve. Other positions may result in uneven valve plug and cage wear and in improper operation. Support the actuator if it is not installed in the vertical position. For more information, consult your Emerson Process Management sales office.
4. Use accepted piping and welding practices when installing the valve in the line. You can leave internal elastomeric parts in place when welding. For flanged valves, use a suitable gasket between the valve and pipeline flanges.

CAUTION

Depending on valve body materials used, post weld heat treating might be required. If so, damage to internal elastomeric and plastic parts, as well as internal metal parts is possible. Shrunk-fit pieces and threaded connections might also loosen. If post weld heat treating is to be performed, all trim parts should be removed. Contact your Emerson Process Management sales office for additional information.

5. With a leak-off bonnet construction, remove the 1/4 NPT pipe plugs (key 14, figure 4) from the bonnet to hook up the leak-off piping.
6. If continuous operation of the plant is required during inspection or maintenance of the valve, install a three-valve bypass around the control valve assembly.
7. If the actuator and valve are shipped separately, refer to the actuator mounting procedure in the appropriate actuator instruction manual.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however some readjustment will be required to meet specific service conditions.

If the valve has ENVIRO-SEAL™ live-loaded packing or HIGH-SEAL ULF live-loaded packing installed, this initial re-adjustment will probably not be required. See the Fisher instruction manuals titled ENVIRO-SEAL Packing System for Sliding-Stem Valves (D101642X012) or HIGH-SEAL ULF Live-Loaded Packing System (D101453X012) (as appropriate) for packing instructions.

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing lubrication, packing maintenance, trim maintenance, lapping seating surfaces, and valve plug maintenance. All maintenance operations may be performed with the valve in the line.

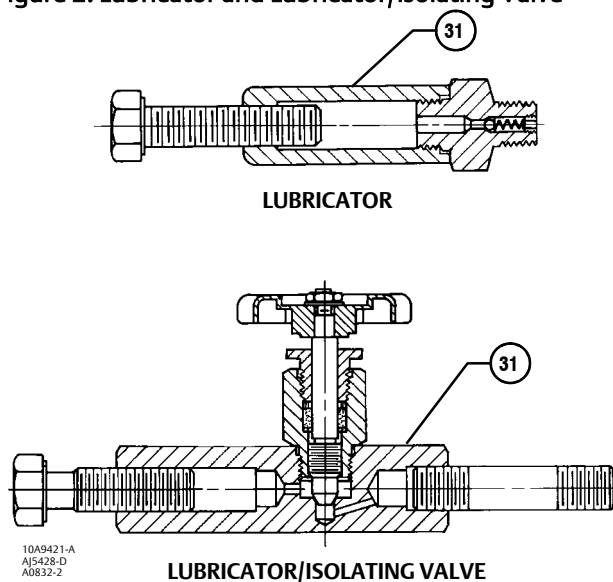
⚠ WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator, release all pressure from the actuator, and use lock-out procedures to prevent injury while you work on the equipment.

Figure 2. Lubricator and Lubricator/Isolating Valve



Note

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, a new gasket should be installed upon reassembly. This is necessary to ensure a good gasket seal because the used gasket might not seal properly.

Note

If the valve has ENVIRO-SEAL live-loaded packing or HIGH-SEAL ULF live-loaded packing installed, see the Fisher instruction manuals titled ENVIRO-SEAL Packing System for Sliding-Stem Valves (D101642X012) or HIGH-SEAL ULF Live-Loaded Packing System (D101453X012) (as appropriate) for packing instructions.

Packing Lubrication

CAUTION

Do not lubricate graphite packing. Graphite packing is self-lubricated. Additional lubrication may result in slip-stick movement of the valve.

If a lubricator or lubricator/isolating valve (figure 2) is provided for PTFE/composition or other packings that require lubrication, it will be installed in place of the 1/4 NPT pipe plug (key 14, figure 4). Use a silicon-base lubricant. To operate the lubricator, turn the cap screw clockwise to force the lubricant into the packing box. The lubricator/isolating valve operates the same way except the isolating valve must first be opened and then closed after lubrication is completed.

Packing Maintenance

This procedure does not cover ENVIRO-SEAL or HIGH-SEAL packing; refer to separate manuals for instructions on those packing types.

Key numbers are shown in figure 3 unless otherwise indicated.

For spring-loaded single PTFE V-ring packing, the spring (key 8) maintains a sealing force on the packing. If leakage is noted around the packing follower (key 13), check to be sure the shoulder on the packing follower is touching the bonnet. If the shoulder is not touching the bonnet, tighten the packing flange nuts (key 5, figure 4) until the shoulder is against the bonnet. If leakage cannot be stopped in this manner, proceed to the Replacing Packing section.

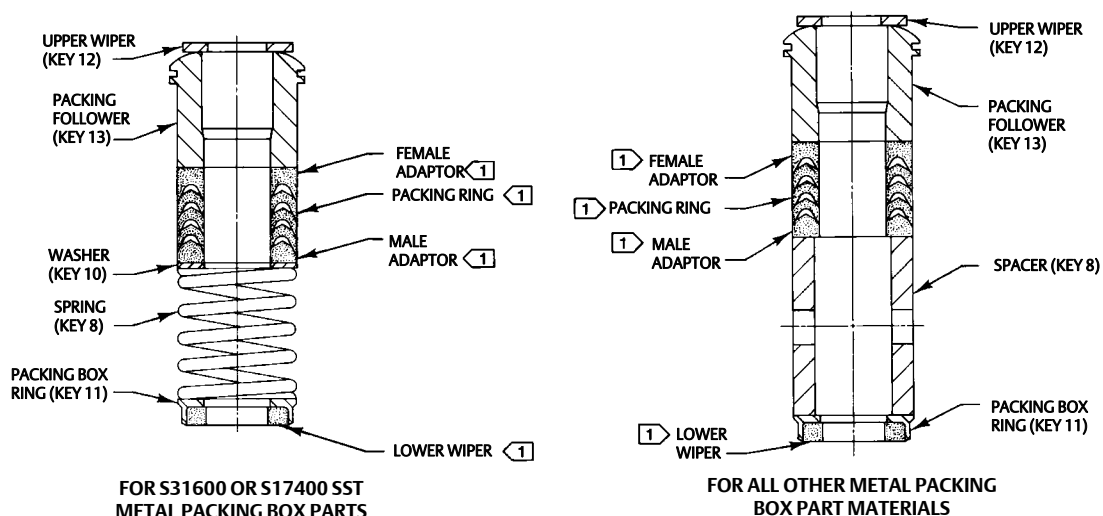
If there is undesirable packing leakage with other than spring-loaded packing, first try to limit the leakage and establish a stem seal by tightening the packing flange nuts.

If the packing is relatively new and tight on the stem and if tightening the packing flange nuts does not stop the leakage, it is possible that the valve stem is worn or nicked so that a seal cannot be made. The surface finish of a new valve stem is critical for making a good packing seal. If the leakage comes from the outside diameter of the packing, it is possible that the leakage is caused by nicks or scratches around the packing box wall. If performing any of the following procedures, inspect the valve stem and packing box wall for nicks and scratches.

Replacing Packing

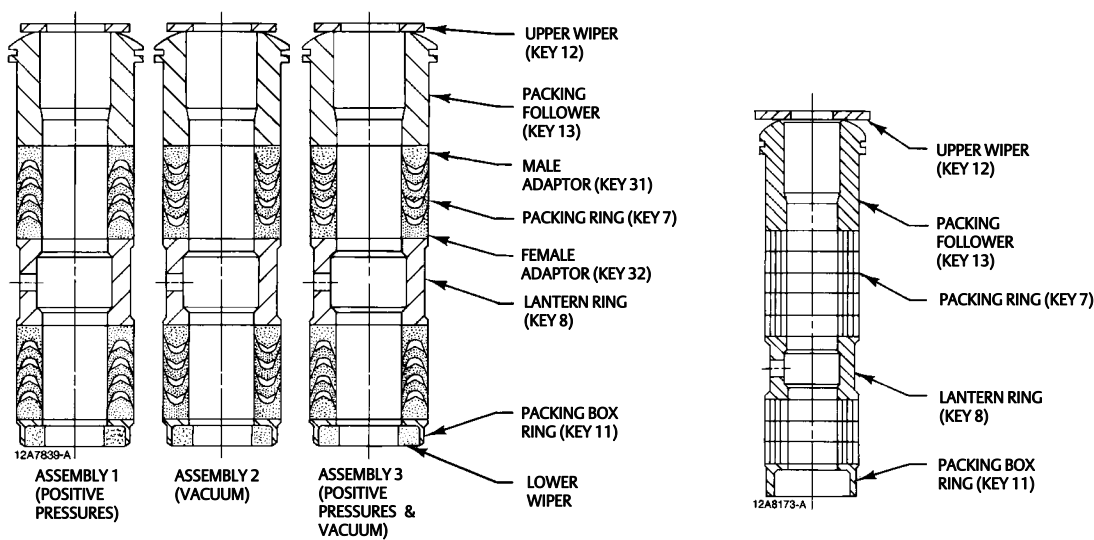
1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator, release all pressure from the actuator, and use lock-out procedures to prevent injury while you work on the equipment.
2. Remove any leak-off piping from the bonnet. Disconnect the stem connector, and then remove the actuator from the valve by unscrewing the hex nuts (key 26, figure 4).
3. Loosen the packing flange nuts (key 5, figure 4) so that the packing is not tight on the valve stem. Remove any travel indicator parts and stem locknuts from the valve stem threads.

Figure 3. Typical Packing



12A7837-A

PTFE V-RING SINGLE ARRANGEMENTS



12A7839-A

12A8173-A

31.8 and 50.8 mm
(1-1/4 and 2 INCH) STEM

PTFE V-RING
DOUBLE ARRANGEMENTS

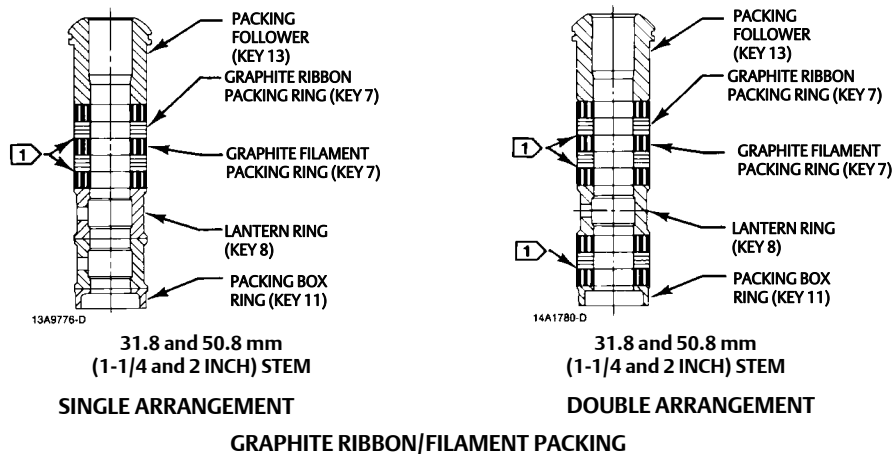
31.8 and 50.8 mm
(1-1/4 and 2 INCH) STEM

PTFE/COMPOSITION
ARRANGEMENT

NOTE:
1) PACKING SET (KEY 6) (2 REQUIRED FOR DOUBLE ARRANGEMENTS)

B2398

Figure 3. Typical Packing (Continued)



NOTE:
 1 0.102 mm (0.004 INCH) THICK SACRIFICIAL ZINC WASHERS:
 USE ONLY ONE BELOW EACH GRAPHITE RIBBON RING.
 A6060

CAUTION

Avoid damage to the seating surfaces caused by the valve plug and stem assembly dropping from the bonnet after being lifted part way out.

When lifting the bonnet (key 1, figure 4), either be sure that the valve plug and stem assembly remains in the valve and on the seat or, temporarily install a valve stem locknut on the valve stem. This locknut will prevent the valve plug and stem assembly from dropping out of the bonnet.

⚠ WARNING

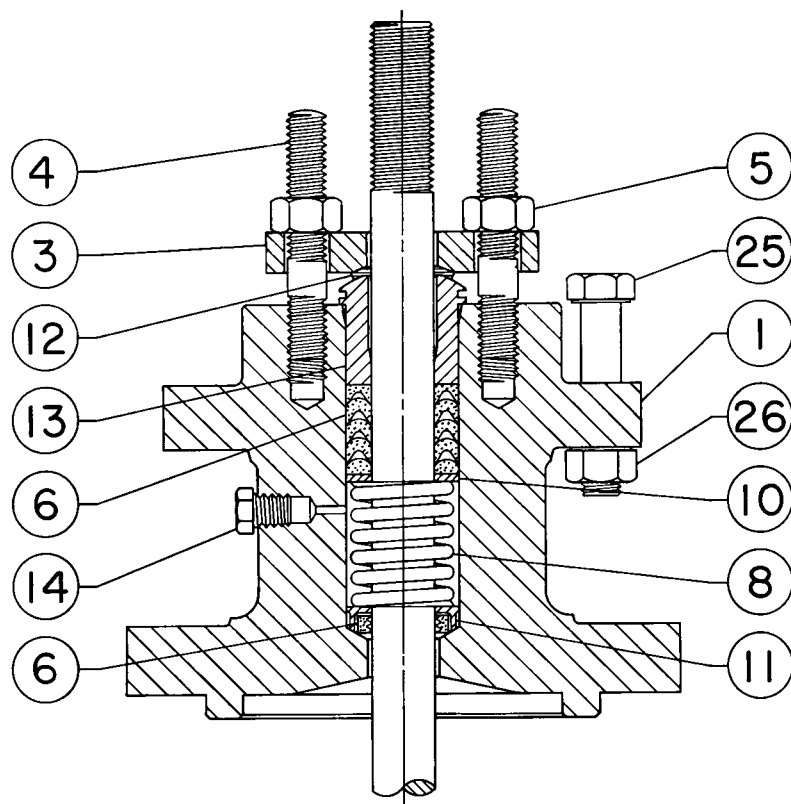
To avoid personal injury or property damage caused by uncontrolled movement of the bonnet, loosen the bonnet by following the instructions in the next step. Do not remove a stuck bonnet by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the bonnet. If the cage sticks to the bonnet, proceed carefully with bonnet removal.

Note

The following step also provides additional assurance that the valve body fluid pressure has been relieved.

4. Hex nuts (key 16, figures 5 or 6) attach the bonnet to the valve body. Loosen these nuts or cap screws approximately 3 mm (1/8 inch). Then loosen the body-to-bonnet gasketed joint by either rocking the bonnet or prying between the bonnet and valve body. Work the prying tool around the bonnet until the bonnet loosens. If no fluid leaks from the joint, remove the nuts completely and carefully lift the bonnet (key 1, figure 4).
5. Set the bonnet on a protective surface to prevent damage to the bonnet gasket surface.
6. Whenever the bonnet has been removed, replace the bonnet gasket and the cage gasket (keys 10 and 11, figures 5 and 6). Remove the bonnet gasket.

Figure 4. Typical Globe Valve Bonnet



CU4317

7. Lift the valve plug and stem assembly out of the valve body and set it on a protective surface. If the valve plug is to be reused, protect the valve plug seating surface to prevent scratches.

Table 3. Packing Flange Nut Torque for Packing Without a Spring

VALVE STEM DIAMETER		PRESSURE RATING	GRAPHITE-TYPE PACKING				PTFE-TYPE PACKING			
			Minimum Torque		Maximum Torque		Minimum Torque		Maximum Torque	
mm	Inch		N•m	Lbf•ft	N•m	Lbf•ft	N•m	Lbf•ft	N•m	Lbf•ft
31.8	1-1/4	CL150 & 300	33	24.3	49	36.1	16	11.8	25	18.4
		CL600	45	33.2	67	49.4	21	15.5	33	24.3
50.8	2	CL300	43	32	65	48	20	15	31	23
		CL600	61	45	91	67	27	20	41	30

Table 4. Body-to-Bonnet Bolt Torque

BOLT SIZE, INCH	THREADS PER INCH	BOLTING TORQUE ⁽¹⁾	
		N•m	Lbf•ft
1-1/4	8	990	730
1-1/2	8	1750	1290

1. For B7, B7M, B16, and 660 bolting materials. For other materials, contact your Emerson Process Management sales office for torque values.

8. Install screws or bolts into the tapped holes in the top of the cage assembly (key 3), and carefully lift it out of the valve body. Remove the cage gasket (key 11).
9. If further trim maintenance is required, refer to the Trim Maintenance section.

CAUTION

To prevent damage to the valve cavity, packing box wall, and packing surfaces, observe the instructions in the next three steps.

10. Cover the opening in the valve body to protect the gasket surface and prevent foreign material from getting into the valve cavity.
11. Remove the packing flange nuts, packing flange, upper wiper, and packing follower (keys 5, 3, 12, and 13, figure 4). Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall. Clean the packing box and the metal packing parts.
12. Inspect the valve stem threads and packing box surfaces for any sharp edges that might cut the packing. Scratches or burrs could cause packing box leakage or damage to the new packing. If the surface condition cannot be improved by light sanding or honing with a tool similar to an automotive brake-cylinder hone, replace the damaged parts.
13. Remove the covering protecting the valve cavity, and install a new cage gasket (key 11, figure 5 and 6), making sure the gasket seating surfaces are clean and smooth.
14. Re-install the trim parts by following the Trim Replacement section. Install a new bonnet gasket (key 10, figure 5 and 6).

Note

Proper performance of the tightening procedures in step 15 compresses the bonnet and cage gaskets (keys 10 and 11, figure 5 and 6) enough to seal the body-to-bonnet joint.

The bolting procedures in step 15 include--but are not limited to--ensuring that bolting threads are clean and evenly tightening the hex nuts onto the studs in a crisscross pattern. Because of the boltup characteristics of the gaskets, tightening one nut may loosen an adjacent nut. Repeat the crisscross tightening pattern several times until each nut is tight and the body-to-bonnet seal is made.

Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson Process Management representative immediately if a discrepancy between actual parts and approved parts is suspected.

15. Lubricate the stud bolts (key 15, figure 5 and 6) with anti-seize lubricant, slide the bonnet over the stem and onto the bolts, and secure with the stud bolt nuts (key 16, figure 5 and 6), using accepted bolting procedures during tightening so that the body-to-bonnet joint will withstand test pressures and application service conditions. Refer to table 4 for bolting torque guidelines.

16. Install new packing and the metal packing box parts according to the appropriate arrangement in figure 3. Place a smooth-edged pipe over the valve stem, and gently tap each soft packing part into the packing box one piece at a time, being sure that air is not trapped between adjacent soft parts.
17. Slide the packing follower, upper wiper, and packing flange (keys 13, 12, and 3, figure 4) into position. Lubricate the packing flange studs (key 4, figure 4) and the faces of the packing flange nuts (key 5, figure 4). Replace the packing flange nuts.
18. **For spring-loaded PTFE V-ring packing**, tighten the packing flange nuts until the shoulder on the packing follower (key 13, figure 4) contacts the bonnet.

For graphite packing, tighten the packing flange nuts to the maximum recommended torque shown in table 3. Then, loosen the packing flange nuts and retighten them to the recommended minimum torque shown in table 3.

For other packing types, tighten the packing flange nuts alternately in small, equal increments until one of the nuts reaches the minimum recommended torque shown in table 3. Then, tighten the remaining flange nut until the packing flange (key 3, figure 4) is at a 90-degree angle to the valve stem.

19. Mount the actuator on the valve assembly, and reconnect the actuator and valve stem according to the procedure in the appropriate actuator instruction manual. Check for leakage around the packing follower when the valve is being put into service. Retighten the packing flange nuts as required.

Trim Maintenance

Trim Removal

Except where indicated, key numbers in this section are shown in figure 6 for ET valves and in figure 5 for ED valves.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator, release all pressure from the actuator, and use lock-out procedures to prevent injury while you work on the equipment.
2. Remove the actuator and the bonnet according to steps 2 through 5 of the Replacing Packing Section.

CAUTION

Use care to avoid damaging gasket surfaces.

The surface finish of the valve stem (key 7) is critical for making a good packing seal. The inside surface of the cage or cage assembly (key 3) is critical for smooth operation of the valve plug and for making a seal with the seal ring (key 28). The seating surfaces of the valve plug (key 2) and seat ring (key 9) are critical for proper shutoff. Assume all these parts are in good condition, and protect them accordingly unless inspection reveals otherwise.

3. Packing parts can be removed if desired. Replace these parts as described in the Packing Replacement section.
4. Lift the valve plug and stem assembly out of the valve body and set it on a protective surface. If the valve plug is to be reused, protect the valve plug seating surface to prevent scratches.
5. Install screws or bolts into the tapped holes in the top of the cage assembly (key 3), and carefully lift it out of the valve body. Remove the gaskets (keys 10 and 11).
6. Proceed as appropriate:

For ET valves (figure 5), the valve has a seat ring seal ring (key 6). Inspect this seal ring, and remove it if replacement is necessary. The seat ring is screwed into the cage and secured with two tack welds, one on each side of the cage. Remove the tack welds by grinding or filing them off.

For ET valves with HTS1 option (figure 7), the valve has a seat ring seal ring (figure 5, 6, or 7, key 6). Inspect this seal ring, and remove it if replacement is necessary. To remove the seal ring, the retaining ring (key 227) must be removed first. After the retaining ring is removed, the seal ring (key 6), backup ring (key 226), and anti-extrusion rings (key 225) can be removed. The seat ring is screwed into the cage and secured with two tack welds, one on each side of the cage. Remove the tack welds by grinding or filing them off.

- There are two 3/8-inch UNC tapped holes in the bottom of the seat ring. Screw cap screws into these holes. Use a bar to pry against the cap screws and turn the seat ring out of the cage.

For ED valves (figure 6), unscrew the seat ring cap screws (key 49). Install screws or bolts into the tapped holes in the top of the seat ring (key 9) and carefully lift it out of the valve body. Remove the gasket (key 13).

7. Inspect parts for wear or damage that would prevent proper operation of the valve. Replace or repair trim parts according to the following Lapping Seating Surfaces or Valve Plug Maintenance procedures as appropriate.

Lapping Seating Surfaces

A certain amount of leakage should be expected with metal-to-metal seating in any valve body. If the leakage becomes excessive, however, the condition of the seating surfaces of the valve plug and seat ring can be improved by lapping. (Deep nicks should be machined out rather than ground out.) Use a good quality lapping compound of a mixture of 280 to 600-grit. Apply the compound to the bottom of the valve plug.

Assemble the valve to the extent that the cage or cage assembly is in place and the bonnet is bolted to the valve body. A simple handle can be made from a piece of strap iron locked to the valve plug stem with nuts. Rotate the handle alternately in each direction to lap the seats. After lapping, remove the bonnet, and clean the seat surfaces. Completely assemble the valve as described in the Trim Replacement section, and test the valve for shutoff. Repeat the lapping procedure if leakage is still excessive.

Valve Plug Maintenance

Except where indicated, key numbers in this section are shown in figure 6 for ET valves and in figure 5 for ED valves.

CAUTION

For valves with a PTFE seal ring (figure 5, 6, or 7), if replacing the valve plug seal ring (key 28), be careful not to scratch the surfaces of the ring groove in the valve plug or any of the surfaces of the replacement ring, or the replacement ring may not seal properly.

1. Remove the valve plug (key 2) according to the Disassembly section.
2. **For ET constructions,** carefully pry or cut the seal ring (key 28, figure 5, 6, or 7) from its groove in the plug.

Install the replacement spring-loaded seal ring with the open side facing the top or bottom of the valve plug, depending on flow direction. The open side of the seal ring should face up (toward the actuator) in flow-up installations and down in flow-down installations.

To install the seal ring, first lubricate it with general-purpose, lithium-base lubricant. Then gently stretch the seal ring and work it over the top edge of the valve plug. Give the PTFE material in the seal ring time to cold flow during the stretching procedure. Avoid jerking sharply on the ring. Stretching the seal ring over the valve plug might make it seem loose when it is in the groove, but it will shrink to its original size after you have installed the plug into the cage.

3. **For ET valves with HTS1 option (figure 5, 6, or 7),** carefully pry the retaining ring from the groove in the plug. Then remove the seal ring (key 28), backup ring (key 29), and anti-extrusion ring (key 219). Install the seal ring and other parts according to figure 5, 6, or 7. The open side faces the valve stem for Whisper Trim III, WhisperFlo, and flow-up standard cages. Reverse the seal ring for flow-down cages.

For ET valves with HTS1 option, install the seat ring seal ring (key 6) so that its open side faces the valve stem for Cavitrol III trim and flow-down standard cages. Reverse the seal ring for Whisper Trim III, WhisperFlo, and flow-up standard cages so its open side faces away from the valve stem. Lubricate the seal ring (key 6), backup ring (key 226), anti-extrusion ring (key 225), and retaining ring (key 227) with a general-purpose, lithium-base lubricant, and slide the seal ring, backup ring, and anti-extrusion ring over the seat ring according to figure 5, 6, or 7. Start the retaining ring in the groove on one side of the seat ring, and gently work it over the seat ring.

4. **For ED constructions**, each of the piston rings (key 28, figure 5, 6, or 7) is in two pieces; remove the pieces.

Each new graphite piston ring is furnished as a complete ring, and each must be broken into two approximately equal portions. Do this by placing the ring on edge on a smooth, hard surface and striking the ring squarely with a hammer. Be sure to match the broken ends when installing the ring sections in the valve plug grooves.

CAUTION

Never reuse an old stem (key 7) with a new valve plug. Using an old stem with a new plug requires drilling a new pin hole in the stem. This weakens the stem and may cause it to fail in service. However, a used valve plug may be reused with a new stem.

5. To replace the valve stem (key 7), drill out the pin (key 8) and unscrew the stem from the valve plug.
6. Screw the new stem tightly into the valve plug. Drill through the stem, using a 1/4-inch diameter drill for the 31.8 mm (1-1/4 inch) stem diameter used in this valve. Use the hole in the valve plug as a guide. Remove any chips or burrs, and drive in a new pin to lock the assembly.

Trim Replacement

Except where indicated, key numbers are shown in figure 5 and 6.

1. Proceed as appropriate:

For ET valves:

Insert cap screws in the two 3/8-inch tapped holes in the bottom of the seat ring (key 9). Use a bar to pry against the cap screws and turn the seat ring (key 9) into the cage (key 3).

For all sizes, tack weld the seat ring to the cage using minimal heat. Two welds, 6 mm (1/4-inch) long and 180 degrees apart, are required. Install the seat ring seal ring (key 6) so that its open side faces the valve stem for Cavitrol III trim and flow-down standard cages. Reverse the seal ring for Whisper Trim III, WhisperFlo, and flow-up standard cages. Lubricate the seal ring with a general-purpose, lithium-base lubricant, and place it over the bottom end of the seat ring. Start the ring in the groove on one side of the seat ring, and gently work it over the seat ring.

For ET valves with HST1 option:

For all sizes, tack weld the seat ring to the cage using minimal heat. Two welds, 6 mm (1/4-inch) long and 180 degrees apart, are required. For ET valves with HTS1 option, install the seat ring seal ring (key 6) so that its open side faces the valve stem for Cavitrol III trim and flow-down standard cages. Reverse the seal ring for Whisper Trim III, WhisperFlo, and flow-up standard cages so its open side faces away from the valve stem. Lubricate the seal ring (key 6), backup ring (key 226), anti-extrusion ring (key 225), and retaining ring (key 227) with a general-purpose, lithium-base lubricant, and slide the seal ring, backup ring, and anti-extrusion ring over the seat ring according to figure 5, 6, or 7. Start the retaining ring in the groove on one side of the seat ring, and gently work it over the seat ring.

For ED valves (figure 6), install the seat ring gasket (key 13).

Temporarily install screws or bolts into the tapped holes in the seat ring (key 9), making sure the seating surface is facing up. Lower the seat ring into the valve body. Remove the temporary screws or bolts.

Secure the seat ring (key 9) with the cap screws (key 49). Tighten the cap screws in a criss-cross pattern to a torque of 39 N•m (29 lbf•ft) for NPS 12, 14, and 16 valves.

2. Install a cage gasket (key 11) into the valve. Temporarily install screws or bolts into the tapped holes in the top of the cage assembly (key 3) to help while installing this piece into the valve. Any rotational orientation of the cage or assembly with respect to the valve is acceptable.

For ET valves, use care to avoid damaging the seat ring seal ring and cage seating surfaces while handling the heavy parts. To help insert the cage or assembly into the valve, lubricate the outside diameter of the seat ring seal ring with lithium grease.

3. Slide the valve plug (key 2) and stem assembly into the cage.

For valves with a seal ring, make sure the valve plug seal ring (key 28) is evenly engaged in the entrance chamfer at the top of the cage or cage assembly to avoid damaging the ring.

For valves with piston rings, make sure the rings are fully engaged into the piston ring groove and flush with the outside diameter of the plug.

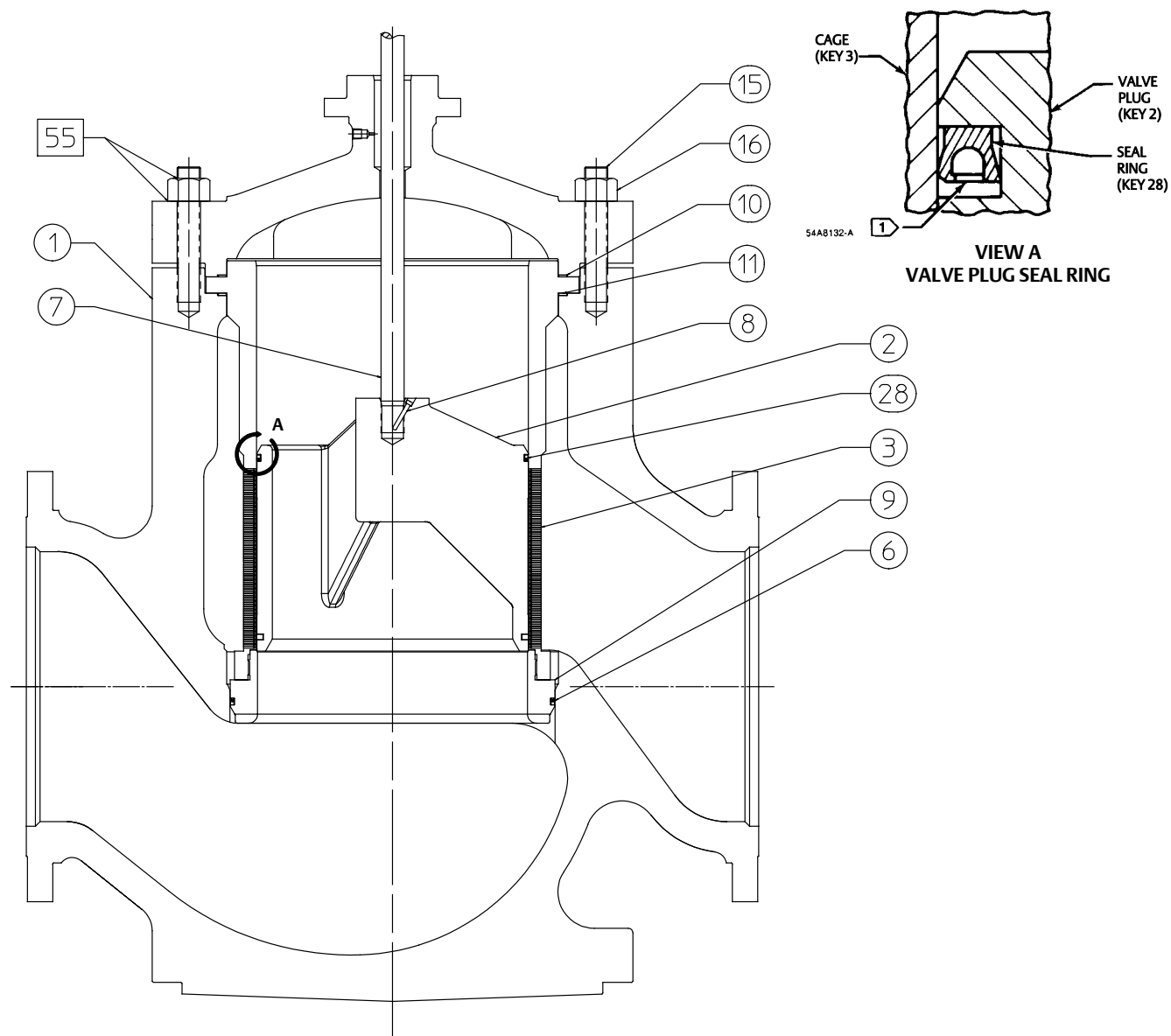
4. Install the bonnet gasket (key 10).

CAUTION

If the packing is to be reused and was not removed from the bonnet, use care when installing the bonnet to avoid damaging the packing with the valve stem threads.

5. Mount the bonnet on the valve, and complete assembly according to steps 15 through 19 of the Replacing Packing section, omitting steps 16 and 17 if new packing is not being installed and being sure to observe the note before step 15.

Figure 5. Typical Fisher ET Valve



NOTE:

1 SEAL RING OPENING MUST FACE SEAT RING FOR FLOW DOWN APPLICATIONS AND MUST FACE ACTUATOR FOR FLOW UP APPLICATIONS.

Figure 6. Typical Fisher ED Valve

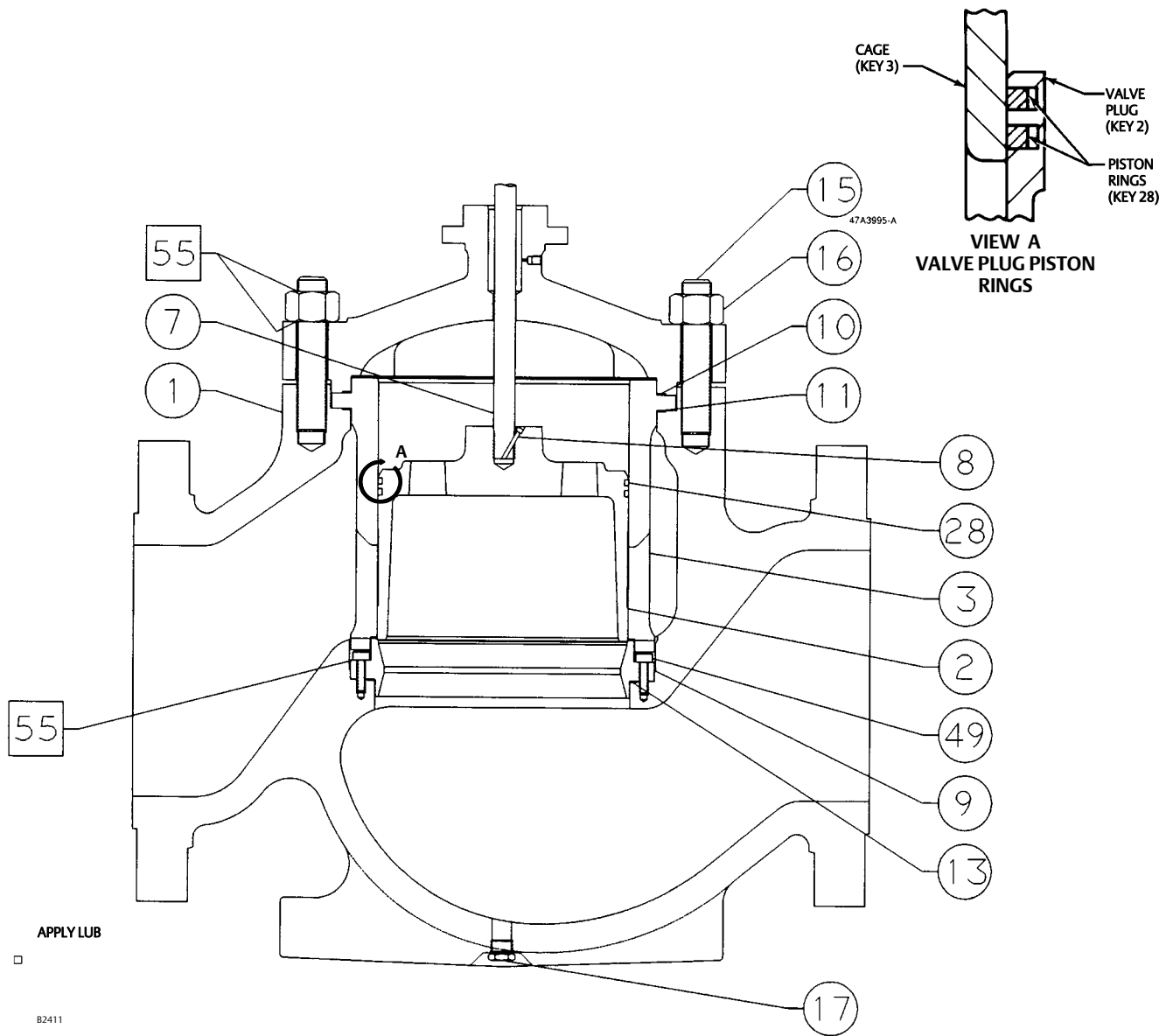


Figure 7. Typical Fisher ET Valve with HTS1 Option

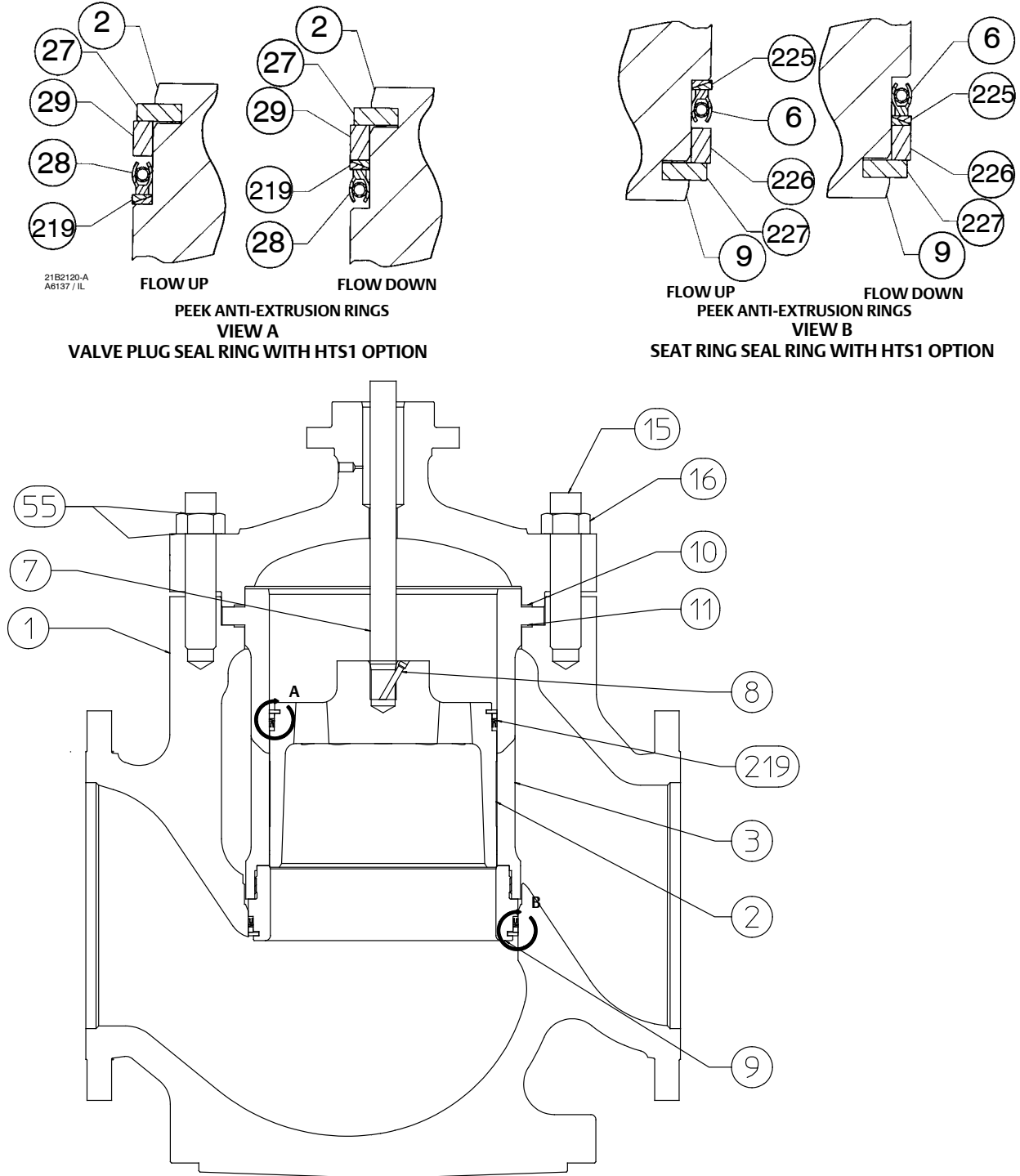
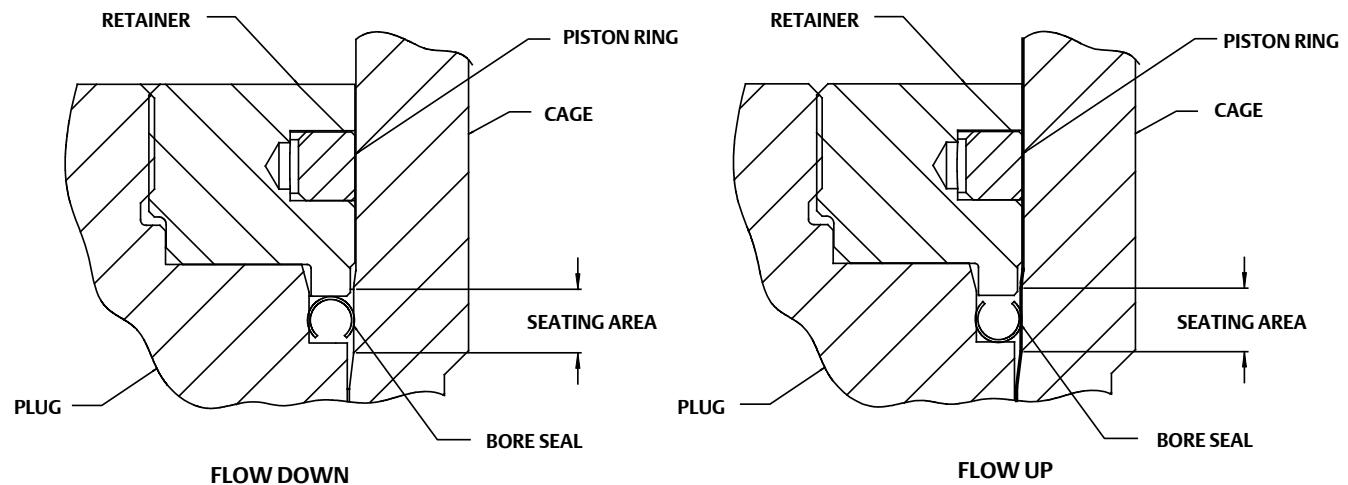


Figure 8. Fisher Large ED with Bore Seal Trim



Retrofit: Installing Bore Seal Trim

Note

Additional actuator thrust is required for a valve with Bore Seal trim. When installing Bore Seal trim in an existing valve, contact your Emerson Process Management sales office for assistance in determining new actuator thrust requirements.

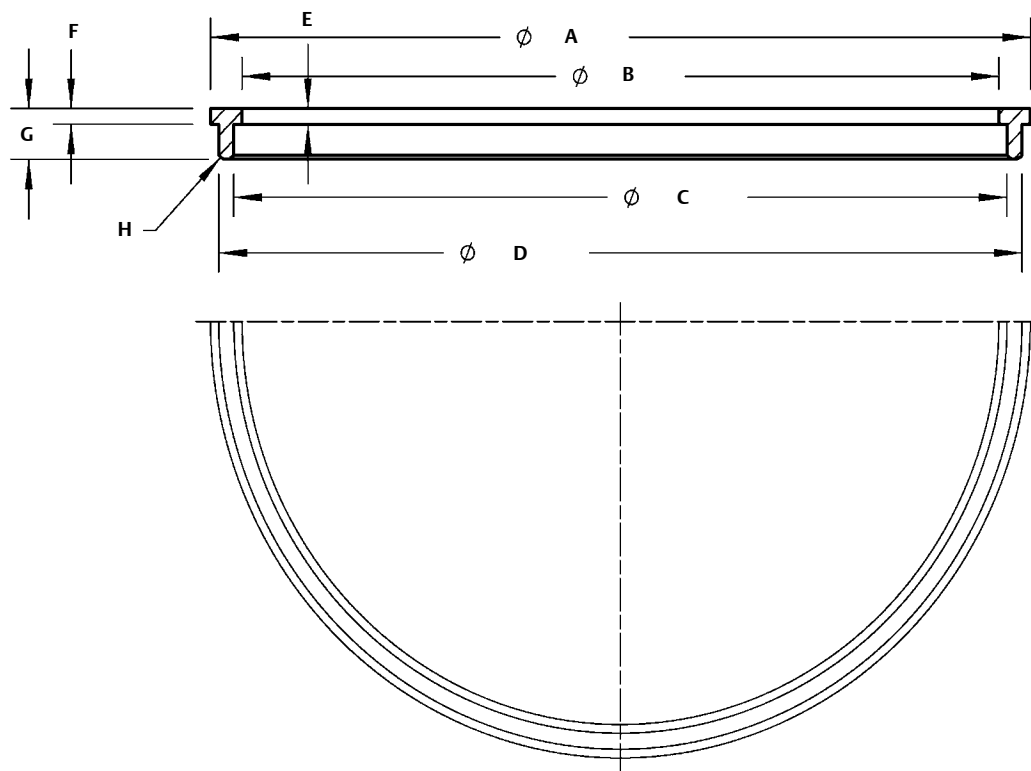
Assemble the new valve plug/retainer assembly (with Bore Seal plug seal) using the following instructions:

CAUTION

To avoid leakage when the valve is returned to service, use appropriate methods and materials to protect all sealing surfaces of the new trim parts while assembling the individual parts and during installation in the valve body.

1. Apply a suitable high-temperature lubricant to the inside diameter of the Bore Seal plug seal. Also, lubricate the outside diameter of the valve plug where the Bore Seal plug seal must be pressed into the proper sealing position (figure 8).
2. Orient the Bore Seal plug seal for correct sealing action based on the process fluid flow direction through the valve.
 - The open interior of the Bore Seal plug seal must face up in a valve with flow-up construction (figure 8).
 - The open interior of the Bore Seal plug seal must face down in a valve with flow-down construction (figure 8).
3. Place the Bore Seal plug seal over the top of the valve plug. The retainer will help guide the Bore Seal down onto the plug (figure 8). Do not force the Bore Seal over the plug. For flow down constructions, skip to step 5.
4. An installation tool (see table 5) must be inserted into the Bore Seal prior to using the retainer to guide it down the plug.

Figure 9. Bore Seal Installation Tool



GE22109-A

Table 5. Bore Seal Installation Tool Dimensions

VALVE PORT SIZE, INCH	Dimensions, Inches (See Figure 9)								Tool Part Number
	A	B	C	D	E	F	G	H	
10.00	10.12	9.7	9.80-9.82	10.02-10.00	0.10	0.10	0.32	R.06	GE17914X012
11.00	(1)								n/a

1. For sizes, contact your Emerson Process Management sales office.

5. Apply a suitable high-temperature lubricant to the threads on the plug. Then, place the Bore Seal retainer onto the plug and tighten the retainer using an appropriate tool such as a strap wrench. For flow down constructions, skip to step 7.
6. Remove the retainer and then the installation tool. Place the Bore Seal retainer back onto the plug and tighten the retainer using an appropriate tool such as a strap wrench.
7. Using an appropriate tool such as a center punch, stake the threads on top of the plug in one place (figure 10) to secure the Bore Seal retainer.
8. Install the new plug/retainer assembly with Bore Seal on the new stem following the appropriate instructions in the Trim Replacement section of this manual.
9. Install piston rings by following instructions in the Trim Replacement section of this manual.
10. Remove the existing valve actuator and bonnet following the appropriate instructions in the Replacing Packing section of this manual.

CAUTION

Do not remove the existing valve stem from the valve plug unless you are planning to replace the valve stem.

Never reuse an old valve stem with a new plug or reinstall a valve stem after it has been removed. Replacing a valve stem requires drilling a new pin hole in the stem. This drilling weakens the stem and may cause failure in service. However, a used valve plug may be reused with a new valve stem.

11. Remove the existing valve stem and plug, cage, and seat ring from the valve body following the appropriate instructions in the Trim Removal section of this manual.
12. Replace all gaskets according to appropriate instructions in the Trim Replacement section of this manual.
13. Install the new seat ring, cage, valve plug/retainer assembly, and stem into the valve body and completely reassemble the valve package following the appropriate instructions in the Trim Replacement section of this manual.

CAUTION

To avoid excessive leakage and seat erosion, the valve plug must be initially seated with sufficient force to overcome the resistance of the Bore Seal and contact the seat ring. You can correctly seat the valve plug by using the same force calculated for full load when sizing your actuator. With no pressure drop across the valve, this force will adequately drive the valve plug to the seat ring, thus giving the Bore Seal a predetermined permanent set.

With full actuator force applied and the valve plug fully seated, align the actuator travel indicator scale with the lower end of valve travel. Refer to the appropriate actuator instruction manual for information on this procedure.

Replacement of Installed Bore Seal Trim

Trim Removal (Bore Seal Constructions)

1. Remove the valve actuator and bonnet following the appropriate instructions in the Replacing Packing section of this manual.

CAUTION

To avoid leakage when the valve is returned to service, use appropriate methods and materials to protect all sealing surfaces of the trim parts during maintenance.

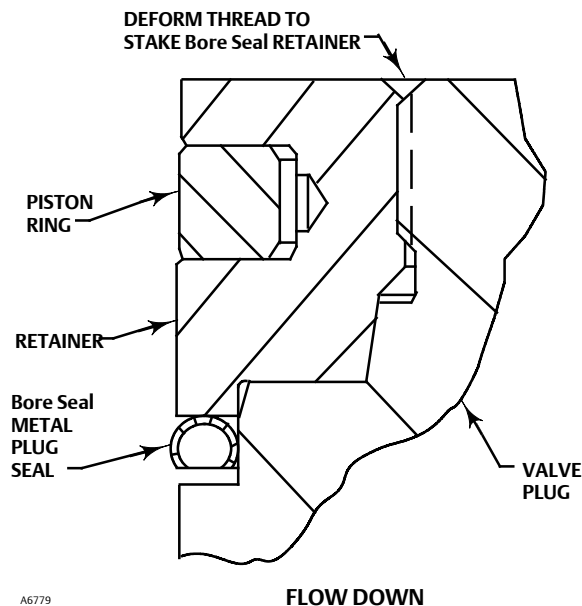
Use caution when removing piston ring(s) and the Bore Seal to avoid scratching any sealing surface.

CAUTION

Do not remove the valve stem from the plug/retainer assembly unless you are planning to replace the valve stem.

Never reuse an old valve stem with a new plug or reinstall a valve stem after it has been removed. Replacing a valve stem requires drilling a new pin hole in the stem. This drilling weakens the stem and may cause failure in service. However, a used valve plug may be reused with a new valve stem.

2. Remove the plug/retainer assembly (with Bore Seal), cage, and seat ring from the valve body following the appropriate instructions in the Trim Removal section of this manual.
3. Locate the staked thread on top of the valve plug (figure 10). The staked thread secures the retainer. Use a drill with a 1/8 inch bit to drill out the staked area of the thread. Drill approximately 1/8 inch into the metal to remove the staking.

Figure 10. Stake the Threads of the Bore Seal Retainer

4. Locate the break between sections of the piston ring(s). Using an appropriate tool such as a flat-blade screwdriver, carefully pry out the piston ring from the groove in the Bore Seal retainer.
5. After removing the piston ring, locate the 1/4-inch diameter hole in the groove.
6. Select an appropriate tool such as a punch and place the tip of the tool into the hole with the body of the tool held tangent to the outside diameter of the retainer. Strike the tool with a hammer to rotate the retainer and free it from the valve plug. Remove the retainer from the plug.
7. Use an appropriate tool such as a flat-blade screwdriver to pry the Bore Seal plug seal off the plug. Use caution to avoid scratches or other damage to the sealing surfaces where the Bore Seal plug seal makes contact with the valve plug (figure 11).
8. Inspect the lower seating surface where the valve plug contacts the seat ring for wear or damage which would prevent proper operation of the valve. Also, inspect the upper seating surface inside the cage where the Bore Seal plug seal contacts the cage, and inspect the sealing surface where the Bore Seal plug seal makes contact with the plug (figure 11).
9. Replace or repair trim parts according to the following procedure for lapping metal seats, remachining metal seats, or other valve plug maintenance procedures as appropriate.

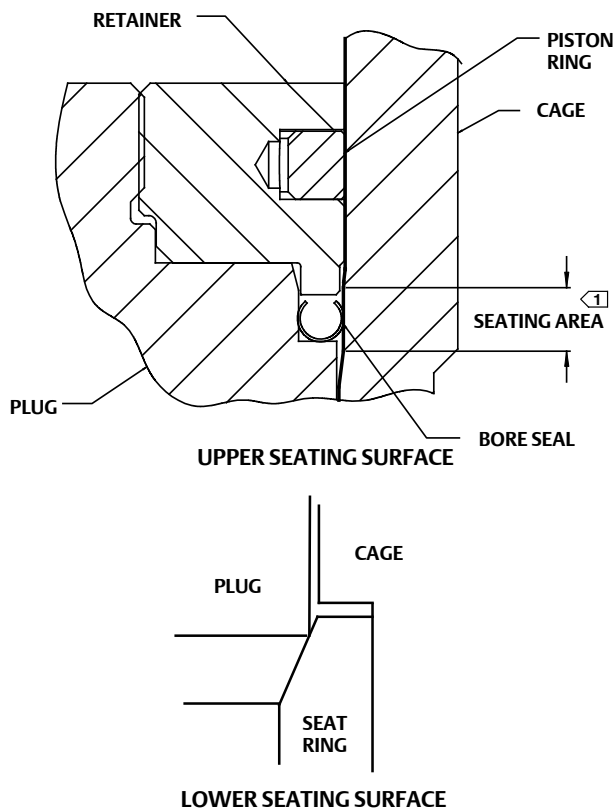
Lapping Metal Seats (Bore Seal Constructions)

Before installing a new Bore Seal plug seal, lap the lower seating surface (valve plug to seat ring, figure 11) following appropriate procedures in the Lapping Seats section of this manual.

Remachining Metal Seats (Bore Seal Constructions)

A valve plug with a Bore Seal metal plug seal features two seating surfaces. One seating surface is found where the valve plug contacts the seat ring. The second seating surface is found where the Bore Seal contacts the upper seating surface in the cage. The cage does not require any machining, even when the plug and / or seat ring have been machined.

Figure 11. Lower (Valve Plug to Seat Ring) and Upper (Bore Seal to Cage) Seating Surfaces



NOTE:
 1 UPPER SEATING SURFACE IS THE AREA OF CONTACT BETWEEN
 THE BORE SEAL METAL PLUG SEAL AND THE CAGE.

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Trim Replacement (Bore Seal Constructions)

1. Apply a suitable high-temperature lubricant to the inside diameter of the Bore Seal plug seal. Also, lubricate the outside diameter of the valve plug where the Bore Seal plug seal must be pressed into the proper sealing position (figure 8).
2. Orient the Bore Seal plug seal for correct sealing action based on the process fluid flow direction through the valve.
 - The open interior of the Bore Seal plug seal must face up in a valve with flow-up construction (figure 8).
 - The open interior of the Bore Seal plug seal must face down in a valve with flow-down construction (figure 8).
3. Place the Bore Seal plug seal over the top of the valve plug. The retainer will help guide the Bore Seal down onto the plug. Do not force the Bore Seal over the plug. For flow down constructions, skip to step 5.
4. An installation tool (see table 5) must be inserted into the Bore Seal prior to using the retainer to guide it down the plug.
5. Apply a suitable high-temperature lubricant to the threads on the plug. Then, place the Bore Seal retainer onto the plug and tighten the retainer using an appropriate tool such as a strap wrench. For flow down constructions, skip to step 7.
6. Remove the retainer and then the installation tool. Place the Bore Seal retainer back onto the plug and tighten the retainer using an appropriate tool such as a strap wrench.

7. Using an appropriate tool such as a center punch, stake the threads on top of the plug in one place (figure 10) to secure the Bore Seal retainer.
8. Replace the piston ring(s) following instructions in the Trim Replacement section of this manual.
9. Return the seat ring, cage, plug/retainer assembly, and stem to the valve body and completely reassemble the valve package following the appropriate instructions in the Trim Replacement section of this manual.

CAUTION

To avoid excessive leakage and seat erosion, the valve plug must be initially seated with sufficient force to overcome the resistance of the Bore Seal and contact the seat ring. You can correctly seat the valve plug by using the same force calculated for full load when sizing your actuator. With no pressure drop across the valve, this force will adequately drive the valve plug to the seat ring, thus giving the Bore Seal a predetermined permanent set.

With full actuator force applied and the valve plug fully seated, align the actuator travel indicator scale with the lower end of valve travel. Refer to the appropriate actuator instruction manual for information on this procedure.

Parts Ordering

Each body-bonnet assembly is assigned a serial number, which can be found on the valve. This same number also appears on the actuator nameplate when the valve is shipped from the factory as part of a control valve assembly. Refer to the serial number when contacting your Emerson Process Management sales office for technical assistance. When ordering replacement parts, refer to the serial number and to the key number and part name from the following list. Specify the desired material, if known. Part numbers are shown for packing box parts. Specify the part number if you are ordering packing parts.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Process Management should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Table 6. Approximate Weights

END CONNECTION		APPROXIMATE WEIGHT	
Size, NPS	Type ⁽¹⁾	kg	lb
12	RF	1410	3100
	RTJ		
	BW	1220	2700
14	RF	1565	3450
	RTJ		
	BW	1340	2950
16	RF	1720	3800
	RTJ		
	BW	1450	3200
30 CL300	RF	6690	14750
30 CL600	RF	13600	30000 ⁽²⁾

1. RF—raised face; RTJ—ring-type joint; BW—butt welding.
2. NPS 30 CL600 estimated.

Parts List

Note

Part numbers are shown for recommended spares only. For part numbers not shown, contact your Emerson Process Management sales office.

Valve Body

Key	Description	Part Number
1	Valve Body	
2*	Valve Plug	
3*	Cage	
6*	Seat Ring Seal (ET valve only)	
7*	Valve Plug Stem	

Key	Description	Part Number
8*	Pin	
9*	Seat Ring	
10*	Bonnet Gasket	
11*	Cage Gasket	
13*	Seat Ring Gasket (ED valve only)	
15	Stud	
16	Hex Nut	
17	Drain Plug, optional	
27	Retaining Ring (ET valve only)	
28	Seal Ring (ET valve only)	
28*	Piston Ring (2 req'd) (ED valve only)	
29	Backup Ring (ET valve only)	
49*	Cap Screw (ED valve only)	
219*	PEEK Anti-extrusion ring (ET HTS1 option valve only)	

Bonnet

1	Valve Bonnet	
3	Packing Box Flange	
4	Packing Flange Stud (2 req'd)	
5	Packing Flange Nut (2 req'd)	

PTFE V-Ring Packing

6*	Packing Set, PTFE (1 req'd for single packing; 2 req'd for double packing)	1R290801012
8	Spring, stainless steel (single packing only)	1D387437012
8	Lantern Ring, stainless steel (double packing only)	0W087135072
10	Special Washer, stainless steel (single packing only)	1H995936042

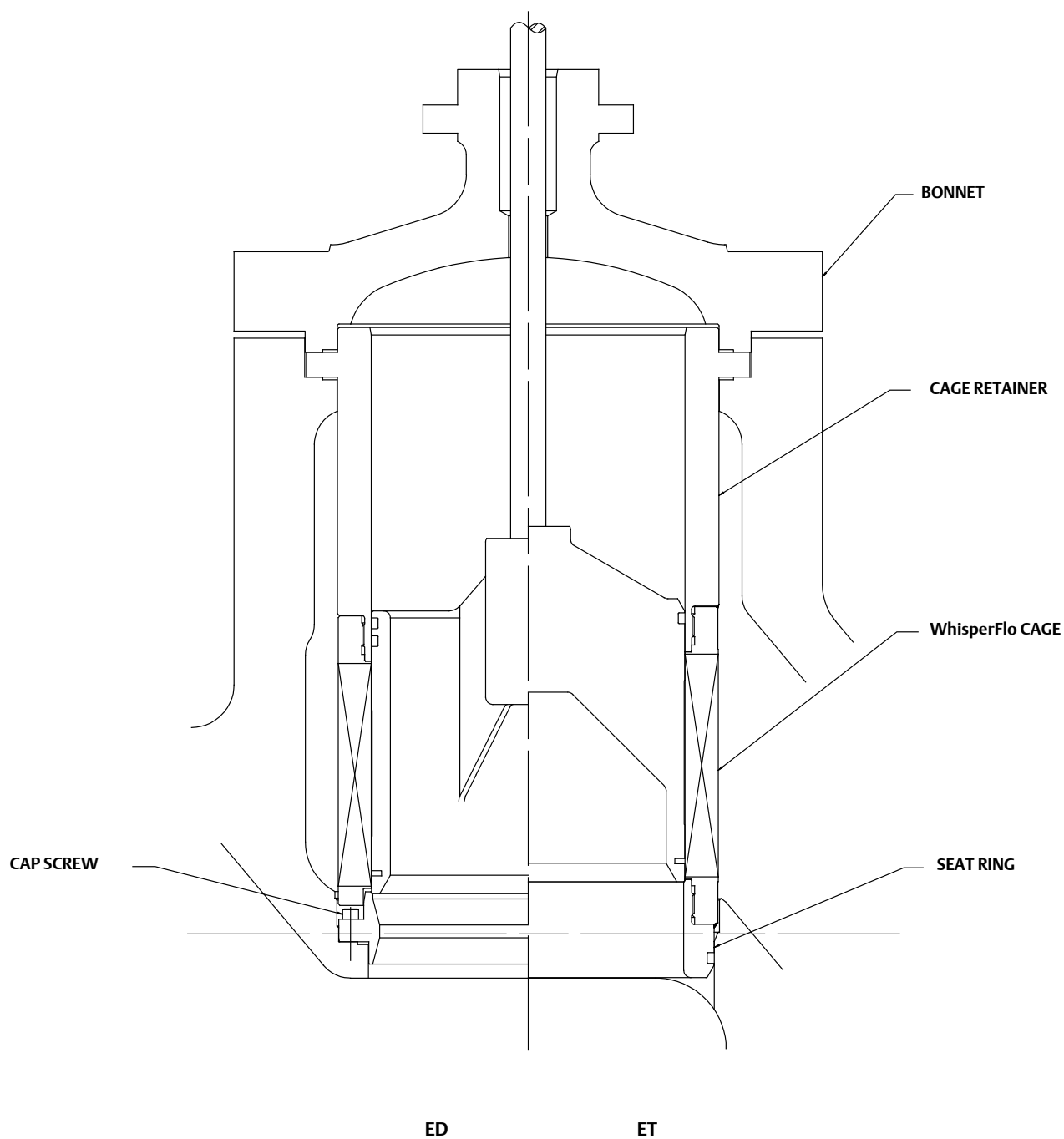
PTFE/Composition Packing

7*	Packing Ring, PTFE/composition (8 req'd)	1D7520X0012
8	Lantern Ring, stainless steel	0W087135072

Graphite Ribbon/Filament Packing

7*	Packing Ring, Graphite Ribbon (2 req'd for single packing; 3 req'd for double packing)	1V5666X0022
7*	Packing Ring, Graphite Filament (3 req'd for single packing; 3 req'd for double packing)	1D7520X0162
8	Lantern Ring, stainless steel (2 req'd for single packing; 1 req'd for double packing)	0W087135072
11	Packing Box Ring	
12*	Upper Wiper, Felt (PTFE packings only)	1J873006332
13	Packing Follower	
14	Pipe Plug	
25	Cap Screw (8 req'd)	
26	Hex Nut (8 req'd)	

Figure 12. Typical Fisher WhisperFlo Trims



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